AN ANALYSIS OF
THE SURGICAL MANAGEMENT OF COMPLEX
PHARYNGO ESOPHAGOGASTRIC CORROSIVE STRICTURES

Dissertation

Submitted to

THE TAMILNADU DR. MGR MEDICAL UNIVERSITY

In partial fulfillment of the requirement for the award of degree of

M.S. DEGREE EXAMINATION

BRANCH – GENERAL SURGERY (BRANCH I)

THE TAMILNADU DR. MGR MEDICAL UNIVERSITY

CHENNAI

SEPTEMBER 2006

CERTIFICATE

This is to certify that this dissertation in **"AN ANALYSIS OF THE SURGICAL MANAGEMENT OF COMPLEX PHARYNGO ESOPHAGOGASTRIC CORROSIVE STRICTURES"** is a genuine work done by **Dr.B.SHANKARI** under my guidance during the period of 2003 – 2006. This has been submitted in partial fulfillment of the award of **M.S. Degree in General Surgery** (Branch – I) by the Tamilnadu Dr.M.G.R. Medical University, Chennai.

Prof. Dr.R.Thirunarayanan M.S., F.I.C.S.,
Prof. and Head of the Department,
Department of General Surgery,
Govt. Royapettah Hospital,
Kilpauk Medical College, Chennai.

Prof. Dr.Thiagavalli Kirubakaran M.D.,
Dean, Kilpauk Medical College
and Hospital, Chennai.

ACKNOWLEDGMENT

I wish to express my gratitude to **Prof.Dr.Thiagavalli Kirubakaran M.D.,** Dean, Kilpauk Medical College, for permitting me to utilize the hospital facilities for conducting the study.

I have great pleasure in expressing my deep sense of gratitude and respect for **Prof.R.Thirunarayanan M.S., F.I.C.S.,** my unit chief and Head of the Department, Department of General Surgery, Kilpauk Medical College, Chennai, for being a constant source of inspiration and encouragement.

I am greatly indebted to **Prof. S.M. Chandramohan M.S., M.Ch.,** Head of the Department, Department of Surgical Gastroenterology, for being kind enough to permit me to utilize the clinical materials from his deparment and also for his valuable guidance.

I owe my sincere thanks to **Dr.K.Rajendran, Dr.T.S.Jeyashri, Dr.M.Deepak,** Assistant Professors, Department of General Surgery but for whose help and guidance, this study would not have been possible.

My sincere thanks to **Dr.M.Kanagavel,** Junior Resident, Department of Surgical Gastroenterology, Government Royapettah Hospital, Chennai, for his indefatigable effort and help required at each and every step, throughout this study.

Last but not the least, I would like to express my gratitude to all those patients included in this study.

CONTENTS

INTRODUCTION

Ingestion of corrosive substances either accidentally by children and alcoholics or intentionally for the purpose of suicide, is a common form of poisoning in India.

Corrosive can produce immediate, progressive & devastating injury of the GIT especially pharynx, esophagus and stomach. The factors that affect the severity of injury are types of corrosive agents, premorbid state of tissue, amount and concentration and contact time of the corrosive agent.

If the patient survives the acute effects, the inflammatory response results in pharyngeal, esophageal and gastric strictures. Management of this problem is a complex one and demands careful evaluation and reconstruction.

Differences in tissue damage between acid and alkaline solutions has been reported with broad consensus that alkaline substances cause much greater cellular damage.

The strictures produced by these corrosive injuries are dense, long, and often multiple frequently requiring surgery.

Esophageal strictures are variable in their response to treatment, some respond to dilatation and other need esophageal replacement. Stomach strictures are treated more easily either by resection or a bypass. The most difficult situations are the pharyngeal and high esophageal strictures as they are associated with high incidence of upper respiratory system complications. The long term results following reconstruction in these strictures are not satisfactory as they lead to swallowing incoordination, repeated aspirations and respiratory infections.

AIM OF STUDY

To analyze the incidence, spectrum of injury, evaluation procedures, treatment options and surgical reconstructive procedures for complex corrosive upper gastro intestinal injuries.

METHODS AND MATERIALS OF STUDY

COMPLEX CORROSIVE UPPER GASTROINTESTINAL INJURIES

BACKGROUND DETAILS:

Government Royapettah Hospital receives about 200 cases of corrosive ingestion every year.

One can understand the volume of cases presented to a single institution. The principle age group of these patients are in the younger and during their most productive period of their life.

These patients present to the hospital in the acute phase consuming either alkali or acid. The commonly used corrosive is toilet cleaning acid. Occasionally there are incidences of phenol ingestion, and caustic ingestion. Very few people who have access to laboratory chemicals consume Sodium Hydroxide, Sodium Carbonate, Sodium metasalicylate, Ammonia Water, Sodium Hypochlorite, Potassium Hydroxide and occasionally unusually combination of these.

Sulphuric acid and hydrochloric acid are the most common acid offenders. Nitric acid, trichloroacetic acid, Potassium and Sodium hydroxide, Sodium Hypochloride, Phenol, Zinc Chloride, Formaldehyde are the others.

In the Surgical Department the referral is essentially for the treatment of the patients who has developed dysphagia.

Most of the time the sequelae is so severe that surgery is the only option for these patients.

WORK UP AND MANAGEMENT

Once these patients present to the department, the following evaluations are done.

TO ASSESS THE EXTENT OF INJURY

i. Contrast studies
ii. UGI scopy
iii. CT scan
iv. MRI
v. Bronchoscopy

B. UPPER GUT EVALUATION

Contrast study remains the main stay to assess the length and severity of stricture. Most of the time barium is used as it produces less trauma even if it is aspirated into tracheobronchial tree.

UGI scopy can tell about the status of the prestenotic gut. It is helpful in patients where the scope is passable to assess the length and severity of strictures.

CT scan gives evidence regarding the damage from the pharynx to the stomach. Usually the loss of contour of the phayngolaryngeal apparatus and esophagus helps us to asses the severity. The thickness of the stricture helps us to asses the severity of the fibroses, the consumed corrosive have evoked. This gives indirect evidence about the possible preanastomotic recurrence of fibrosis in high pharyngeal stricture management . The loss of plane between the esophagus and periesophageal tissues helps one to decide the feasibility of esophagectomy.

In the present scenario MRI is in its infancy. Few patients in this study have underwent MR evaluation of the corrosive injuries. MRI gives the three dimensional reconstruction of the fibrosed pharyngolaryngeal apparatus thus helping the surgeon to locate the placement of anastomosis and to asses the position of vocal cords in relation to the level of anastromosis .

Fibre optic bronchoscoy is very useful in assessing the severity of the injury in patient who have severe glottic stenosis. This also has limitations when the stricture is near total or total where the bronchoscopy will not be able to negotiate the stricture.

LOWER GUT EVALUATION

Large gut evaluation is done usually with a double contrast barium enema or a total colonoscopy. Contrast studies help us to assess the anatomic as well as luminal details. Contrast studies gives an indirect clue about the length of the available colon. Colonoscopy essentially helps in the assessment of luminal details. Arteriographic assessment of the colon have been replaced by the above investigations.

ISSUES IN THE MANAGEMENT

DIFFULTY IN DISTAL ASSESSMENT

Most of the times where the scope cannot pass beyond the stricture, the contrast will also not pas beyond if the stricture in dense. The surgeon will not be able to assess the structures involved and length of the stricture preoperatively. The role of introoperative endoscopy is very useful in the assessment of these patients. Most often once the cervical esophagus is mobilized the scope is attempted to pass on to the esophagus through a cervical esophagotomy. In isolated pharyngeal strictures exclusion of strictures beyond, makes the treatment simpler as a pharyngoplasty alone is sufficient.

NUTRITIONAL ASPECT OF MANAGEMENT

A. ROLE OF PARENTERAL NUTRITION

These patients need atleast a period of 6 months for the stricture to consolidate. Keeping the patients on parenteral nutrition for 6 months becomes impractical. Enteral access is the cornerstone of maintaining the nutritional status of these patients.

B. EARLY ENTERAL ACCESS AND DELAYED DEFINITIVE SURGERY.

Enteral access is made in the form of Feeding Jejunostomy. Feeding gastrostomy is not done for two reasons,

1. To preserve the stomach for a possible gastroplasty at a later date.
2. Associated involvement of the antrum which jeopardizes the desired length and vascularity of the conduit.

Feeding Jejunostomy is done as early as possible, once the patient is un-able to consume any feeds or by the end of two weeks. This allows them to recover from the initial insult. The available liquid acute special diet in the government hospital is an effective nutritional source. This comprises of six eggs and a liter of milk every day. Patients who present early are able to maintain their nutritional status effectively for a period of six months or even longer till they are ready for surgical correction. Patients who present late for feeding access could also improve their nutritional status with this diet.

Enteral access helps the patient to maintain the desired nutritional status required for the complex corrective surgeries. It also helps the patients to tide over the most difficult postoperative phase of the therapy.

PREOPERATIVE WORKUP

THE PREOPERATIVE WORK UP COMPRISES OF

a. Haemogram
b. Basic biochemical test
c. Liver function test
d. Coagulation profile
e. Chest X-ray
f. Electro cardio gram
g. Pulmonary Function Test where indicated

PREOPERATIVE OPTIMISATION

These include maintenance of the nutrition and hydration status. The pulmonary function is improved by way of incentive spirometry. This department has innovated a cost effective method to improve the pulmonary functional status of these patients. A balloon is connected to a syringe barrel and the patient is made to blow into it, 5 minutes every hour. This is easily learnt by the patients. Even though one cannot really assess the flow rate achieved by this method, this is definitely effective in increasing the functional lung capacity.

DEFINITIVE MANAGEMENT

WHEN TO DO?

Usually it takes 6 months for the process of fibrosis to be complete following corrosive ingestion. It is henceforth mandatory for a surgeon to wait for not less than 6 months to avoid postoperative progression of fibrosis. In spite of following this protocol, in few patient's there might be progression of fibrosis as the tissue is handled during the surgery.

WHAT TO DO?

The ideal surgical strategy will be to remove the stricturous segment and to restore the continuity. The ideal surgery should preserve both the speech and the swallowing function of these patients with limited morbidity.

NEED FOR TRACHEOSTOMY?

In acute set up, the need for tracheostomy is essentially to tide over the laryngeal stridor and to provide adequate respiratory toileting in patients who also have inhalational burns. In late cases, temporary tracheostomy in helpful who has moderate pharyngeolaryngeal destruction to tide over the postoperative period. In patients who have total laryngeal and glottic destruction, phayrngolaryngectomy and permanent tracheostomy may be the only choice.

WHICH CONDUIT?

The advantage of colonic conduit is the ease of obtaining required length of the conduit. The pulled up colon depends on the supply from the left colic artery.

In cases where stomach is used the conduit is essentially based on right gastric artery and right gastro epiploic arcade.

WHICH ROUTE?

Most of these patients have severe periesophagitis primarily due to corrosive ingestion or secondary due to dilatation procedures. Hence esophagectomy is done where possible. If esophagectomy is done posterior mediastinal route is utilized for the conduit access. Posterior mediastinum forms the shortest access route to the neck from abdomen. In most of our series patients, retrosternal route is utilized.

Subcutaneous route for pulling up the conduit was the initial technique followed. None of our series patients had subcutaneous conduit access. Subcutaneous access requires the longest conduit and the complication like loss of vascularity, redundancy, and suboptimal cosmetic acceptability have made the modern surgeon to abandon this route.

SURGICAL RECONSTRUCTION

The patient is prepared for surgery after obtaining a high risk informed consent. Preoperative counseling is done to these patients by this department faculty and by the patients who have undergone similar surgeries.

Anaesthesia: General anaesthesia preferably nasotracheal route. The possible need for oral access in difficult pharynx is kept in mind.

Position: Supine with sand bag behind the shoulder blades and head turned to the right side.

Incision: A. Cervical – Left antesternomastoid

B. Abdominal – A midline laporotomy incision extending from xiphoid to below the umbilicus.

Neck (cervical): An anterior oblique antesternomastoid incision is made. The middle thyroid vein is ligated and divided. Care is taken not to injure any structures which run vertically. If needed the omohyoid may be divided. The cervical esophagus is encircled taking care the recurrent laryngeal nerve and the membranous trachea. This step is difficult in patients who have extensive injury and in patients who have underwent dilatation earlier. Decision is made now where to place the anastomosis. It can be in the pharynx or in the cervical esophagus and is based on the severity of the injury.

Abdomen: After laparotomy, the status of the stomach is first ascertained. The vascularity, volume and capacity of the stomach is assessed. The possible antral stricture should also be looked for.

Where the stomach cannot be used due to the nonavailability of the above mentioned reasons, the colon is used.

The colon is mobilized including the two flexures, from ascending to the sigmoid colon level. One should be meticulous in the following steps.

i. Near total detachment of the omentum preserving the colonic vessels

ii. Taking down the splenic flexure without injury to the spleen.

iii. Freeing the hepatic flexure off the duodenum

iv. Limiting the mesenteric dissection so as to avoid hematoma and vascular injury.

Vascular clamps are applied to the middle colic and right colic vessels. This will ensure the colonic vascularity based on the left colic arcade by the time dissection is completed. The entire right colon, transverse colon and the upper left colon is relieved of their attachments.

The required conduit length is measured from the left colic insertion onto the colon upto the pharynx or the esophagus based on the level of stricture. Even though there have been published studies on using the terminal ileum for the neck anastomosis, this department precludes the use of this. We use only the ascending colon for the neck anastomosis.

The required gastric procedure is now done. The need for antrectomy if needed is completed now. There should not be difficulty in the management of distal stomach as the duodenum is effectively spared in these patients. Linear cutter staplers are used to transect the duodenum and the distal stomach. The time utilized in the colonic mobilization and gastric procedures are ideal to ensure and to assess the capacity of the colon to survive the vascular loss due to clamping of the middle and right colic vessel. This time delay ensures the pink conduit at the neck.

Transhiatal esophagectomy where feasible is done by a blunt finger dissection method taking care that the dissection remains close to the esophagus. Where possible the gastroesophageal junction is preserved for neck anastomosis.

The available stomach should be mobilized based on the right gastric and the right gastroepiploic vessels. Care is taken to preserve the epiploic arcade. The short gastric vessels are carefully divided. The left gastric artery is divided and stomach is lifted up. Stomach tubularisation is done usually from the third vessel from the pyloroduodenal junction on the lesser curve side. A segmental stapling method is followed. A kocherisation may be needed where extra conduit length is needed. A pyloroplasty is completed to effectively drain the stomach.

Retrosternal tunnel is made with a sponge on a sponge forceps taking care to retain the instrument as close as possible to the posterior aspect of the sternum, thus avoiding complication of injury to the mediastinal structure. A nasogastric tube is passed from the cervical incision through the tunnel. A over wrap cover is passed on to the abdomen from the cervical side.

Stomach tube or the desired length of the colon is taken up through the retrosternum wrapped in the cover. This effectively maintains the vascularity of the pulled up conduit. In cases of colonic conduit, colon is transected at the desired level and brought up through the retrosternal route.

Colocolic anastomosis is completed. Cologastric anastomosis is completed with staplers. Gastrojejunostomy is done with staplers. Care should be taken to include the esophageal mucosa in the neck anastomosis.

Neck anastomosis is done usually with 2-0 vicryl interrupted sutures. The recent modification is to staple the posterior layer and do the anterior layer hand sewn.

The nasogastric tube is directed downward through the anastomosis to the level of the gastric antrum. This procedure is accompanied by placement of a feeding jejunostomy which substantiates caloric feeding providing nutrition and promotes healing at the anastomosis. Closure of both wounds is done with a drain as required.

POSTOPERATIVE PROBLEMS

In spite of aggressive nutritional improvement these patients do not get their pre ingestion nutritional status. Adding to that, the lungs are overburdened by frequent aspirations. Putting together these patients have both nutritional and respiratory suboptimal status. Hence the complications begin from feeding access. In this department, the normal feeding access by feeding jejunostomy using 10 Fr infant feeding tube.

The complications due to feeding jejunostomy in this department is almost nil. But we have faced problems like slipped tubes, misplaced tubes, malplaced tubes, peritubal leak, leaving the proximal eye of the tube outside the lumen and inadequate securing of tube to anterior abdominal wall. There have been incidences where we have to repeat feeding jejunostomy and resecure nutritional access.

Adequate patients education should be given for these patients to choose careful components of liquid diet, flushing of tube before and after the feed and to keep the entry point of the tube clean.

The feeding jejunostomy procedure followed is using a 10 Fr IFT at about 10-15 cm from the ligament of Trietz in the anti mesenteric border of the jejunum. Double wrapping of the tube once intra luminally and extraluminally by a serosal tunnel is done. This prevents slippage of the tube and peritubal leak. The tube is brought through the rectus outside on the left side as the patients have easier access to feed and left side. The tube is also secured to the skin.

The next most important problem being faced by all surgeons will be a leak at anastomotic site. The leak can be stratified as minor or major based on the amount of the effluent. Usually minor leaks settle by themselves without much trouble. Major

disruptions can be due to

i. Necrosis of the upper end of conduit

ii. Intraoperative hypoxemia

iii. Intraoperative hypotension

iv. Cardiac arrythmias

v. Anaemia

vi. Hypoproteinemia

vii. Faulty techniques

a. Inadequate length of conduit
b. Inadequate diameter of anastomosis
c. Tension at anastomotic site
d. Too tight anastomosis
e. Failure to include esophageal mucosa in anastomosis

6. Poor tissue status due to earlier corrosive injury

Anatomical variation causing inadequate gastroepiploiec arcade, short middle colic arcade and in general atherosclerosis.

PROBLEMS OF CONDUIT AVAILABLITY

Most of the time these patients develop antral strictures. In patients with antral stricture, it becomes impossible to use stomach as conduit. Primary feeding access through gastrostomy also prevents usage of stomach as conduit.

Surgical correction due to emergencies in the post consumption status like perforation closure, partial and subtotal gastrectomy, will also lead to loss of gastric conduit.

At times extensive gastric injuries due to corrosive can also lead to a fully contracted stomach.

The inability to use colon as the conduit may be due to following reasons,

a. Poor mesenteric arcade
b. Short colon
c. Short mesocolon
d. Stumpy middle colic pedicle
e. Early colonic surgery
f. Elderly with atherosclerosis
g. Detection of pathology on laparotomy which has escaped preoperative evaluation of lower gastrointestinal studies and colonoscopy.

In general the use of jejunum as conduit is not followed in this department. In spite of available jejunum, we don't use it as a conduit due to the reason that jejunum loop even though it is longer needs local microvascular anastomosis.

MODIFICATIONS TO IMPROVE OUTCOME

GASTRIC LENGTHENING TECHNIQUES

In patients where the injury is limited to pharynx and esophagus, one can take the gastro esophageal junction as the highest point of anastomosis at the neck by using modified gastric tubularisation techniques against the conventional fundal anastomosis in the neck. These modified methods effectively increases the conduit length by 7 to 9 cm.

IMPROVING COLON BLOOD SUPPLY

Most of the times one will be able to preserve the ascending branch of the left colic artery for vascular augmentation. In select situations, one can also preserve the blood supply from middle colic artery and thus ensuring double augmentation. Where the middle colic vessel is adequately long, the entire conduit can be taken up to the neck based on the middle colic artery itself. It is prudent to decide the length of the colonic conduit recovered before transection to assure the adequacy of length and to avoid redundancy in the abdomen.

MODIFIED ANASTOMOTIC TECHNIQUES

Conventionally hand sewn technique is relied upon for doing anastomosis. Considering the deprived nutritional status and debilitated pulmonary function it is highly desirable one has to reduce the operating time. This is achieved by the use of staplers.

NECK ANASTOMOSIS: Convention neck anastomosis is always by interrupted 2 – 0 vicryl. In cases where is proximal esophagus is adequately wide one can attempt posterior stapler anastomosis and anterior hand sewn anastomosis.

A transverse posterior pharyngotomy is made to improve the anastomotic length and a side – side posterior pharyngocolic anastomosis is completed, thus ensuring a

wider anastomosis. Where in cases the pharynx is fixed, a linear pharyngotomy in done in hypophaynx, and a side – side pharyngoenteral anastomosis is completed. The principle here in to have a wider anastomosis as much as possible.

INTRA – OPERATIVE DILATATION

In patients where the entire pharynx is narrowed the cervical esophagus is accessesed through a esophagotomy and the proximal pharynx is gently dilated by using an endotracheal tube. This is done by doing a bidigital technique / finger dilatation method initially. By this method the operator's left index finger is passed through the cervical esophagus not to pharyngeal side. The operators right index finger is passed in per orally and made to meet across the pharynx. Once the fingers meet, graded dilatation, initially starting with 6Fr size endotracheal tube and upto 8.5 size endotracheal tube is used the cuff inflated. This causes radial dilatation of the stricture. By this way of dilatation one ensures the adequacy of the pre anastomotic pharynx this ensuring good results.

ROLE OF ANASTOMOTIC STENTING

After the completion of anastomosis following the improvised techniques as described earlier, a transnasal endotracheal tube is placed across the anastomosis. This is retained in position for a period of 2 weeks. A nasogastric tube is passed through the endotracheal tube and placed in the stomach to decompress the conduit. The role of anastomotic stenting has definelty improved the outcome of tight pharyngeal stricture correction. After two weeks these patients are kept on weekly endoscopy.

POST OPERATIVE ENDOSCOPY PROTOCOL

The patients who are able to swallow normal solids undergo a check endoscopy after 4 weeks of time. In patient who find it difficult to take solids undergo endoscopy every week.

Patients who develop narrowing in spite of this are subjected to Savary Gilliard dilatation.

ROLE OF SELF DILATATION

In patients who need regular endoscopy to maintain the anastomotic dilatation are kept on Foleys dilatation method.

A novel modification of dilatation is being followed in the department. In patients who have mild to moderate strictures, a Foleys balloon self dilatation protocol is advised. Patient is educated to swallow beyond the stricture level and the bulb of the catheter is inflated with water. Then the Foley catheter is brought out across the anastomosis thus causing a radial dilatation. This is specially beneficial for patients who has post operative anastomotic strictures.

QUALITY OF LIFE AFTER SURGERY

The quality of life after any upper gastrointestinal surgery is assessed by using KARNOFSKI scale and EORTC – QLQOE 30 QOL questionnaire. Most of the patient who survive the stress of the surgery will have good quality of life.

The best way to achieve this is to concentrate on the pre operative nutritional status by providing enteral access, careful selection of conduit, either stomach or colon, ensuring the vascularity of the conduit, following good anastomotic techniques, avoiding intra operative events and good post operative can ensure good quality of life after surgery.

FOLLOW UP

These patients are kept on monthly follow up for first 6 months and later once in 3 months. Patients who are symptomatic undergo earlier endoscopy as per needs. In normal patients endoscopy is done once in 6 months to assess the conduit status.

REVIEW OF LITERATURE

The literature was searched electronically & manually. By checking our references of relevant topics a large amount of data was discovered on complex pharyngoesophageal and gastric corrosive strictures.

Corrosive pharyngeal strictures are not very common. They are usually due to swallowing of very concentrated materials or crystal ingestion. This results in severe corrosive induced spasm of cricopharyngeal sphincter resulting in prolonged contact of toxic agent with the mucosa at these sites resulting in greater degree of injury. Over 70% these patients present with respiratory distress with stridor that are due to severe laryngeal involvement associated with the injury. Pharyngeal burns result in laryngeal injury all the way from mild hoarseness to extensive scar formation and stricture. Such patients may need tracheostomy.

Management of these patient is usually difficult as minority respond to dilatation and rest will need surgery. Different methods of surgery are described. There are innumerable individual publications in the literature quoting the superior results of various types of esophageal replacements. There are no randomized trail or meta analysis to compare the efficacy of each modality of esophageal replacement.

Chernovsov et al, has a fairly big series of 47 cases with colonic esophago pharyngo plasties. Preferences was given to one stage procedure. Graft was constructed from left colon. Mortality rate 2.1%, Pharyngeal anastomotic leak in 10.6% and anstomotic stricture. 8.5%.

Two publications from **TiTk**[20] with experience of 4 patients in one group and 6 paints in the other report that reconstruction of pharyngeal esophageal strictures by

pharyngogastrostomy restores almost normal swallowing provided that the laryngeal function is adequate and a large pharyngogastrostomy is established.

A publication from **Harvard Medical School, Boston, UK,** reports 7 patients with corrosive pharyngeal stricture required total esophageal replacement. 6 underwent isoperistalic right or transverse colon interposition. One had gastric necrosis and so an iliac right colonic substernal interposition was created. No anastomotic leak was found. The author concludes that colonic replacement is ideal for pharyngeal stricture.

Tseng et al, from National Cherny – King University Hospital, Taiwan performed a total of 152, esophageal reconstruction for caustic injuries. Of that hypopharyngeal anastomosis was done in 50 (33%) and rest to cervical anastomosis (67%). He concluded that surgical outcome of pharyngeal stricture is worse than esophageal strictures.

N. Ananthakrishnan et al[1]**,** from JIPMER, Pondicherry, India has reported on 4 patients of pharyngoesophageal stricture who underwent island pectoralis major myocutaneous flap reconstruction. According to him surgical by pass of pharynx above cricopharynx is associated with significant risk of aspiration. So island PMMC flap is used to do a pharygo plasty initially and esophago colic anastomosis for esophageal stricture being done in second stage if needed. He concluded that the island PMMC flap is simple, has dependable vascularity and offer one stage correction for cricopharygeal strictures.

Bassiouny et al[3]**,** from Ain – Shams University, Cairo has reported his experience in 10 patients with pharyngeal strictures. 5 of them had major respiratory problems. Anastomosis was done with colon through retrosternal route in 6 patients and posterior mediastinal route in 4 patients. 70% patients developed anastomotic strictures, but all

responded well to dilatation.

Fujita et al[6]**,** from Japan has presented a case of corrosive pharyngeal stricture with complete obstruction of larynx, which was successfully treated with pharynx esophageal bypass using free jejunal graft. Swallowing was restored. Patient later needed laryngoplasty. Aspiration occurred in immediate post operative period but patient recovered.

Popovici et al[13]**,** has got a largest personal series of 253 esophageal reconstruction, using colon and ileum out of which 124 patients had pharyngocoloplasty. Out of the 124 patients, anastomosis was performed with hypopharynx in 27, oropharynx in 9 and total reconstruction of pharynx in 69 patients. Total post operative mortality rate was 4.7%. Stenosis of cervical anstomosis occurred in 4.9%. 70% resumed normal diet. He concluded that total visceral pharyngeal reconstruction by ileo pharyngoplasty is procedure of choice.

Chen et al, from Taiwan has reported on the efficacy of esophagoplasty with free forearm flap for focal stricture of pharyngoesophageal junction. According to him the procedure is less morbid than other surgeries and provide better aesthetic result. Skin patch does not cause any esophageal motility problems.

Gupta et al[9]**,** from Calcutta National Medical Centre, India has done a study on 72-esophageal replacement. Performed for the past 25 years right colon was used in majority and posterior colopharyngeal anastomosis was performed in all cases. There were 2 early and one late death. He concluded that right colon is the best conduit and posterior pharyngeal anstomosis restores normal deglutition.

STUDY DETAILS

STUDY TYPE:

Retrospective and prospective study.

DATA COLLECTION:

The data pertaining to this study was obtained from the Medical Records Department and the prospective was obtained directly from the patient and treatment records.

The cases included in this study were treated in Department of Surgery and the Department of Surgical Gastroenterology, Government Royapettah Hospital, Chennai from 2001 – 2006.

QUESTIONNAIRE

A questionnaire was designed to collect the data viz., demographic details, primary treatment details, time interval between consumption and stricture formation, location of stricture, length of stricture, earlier treatment details and the type of surgical re-construction the patient underwent.

The patients who had complex corrosive injuries which was involving the pharynx were included in this study.

The questionnaire used is enclosed as Annexure 1.

DATA ANALYSIS

The total number of 49 cases of corrosive strictures that presented to the Department of General Surgery and Department of Surgical Gastroenterology, Government Royapettah Hospital during the period of 2001 – 2006 were taken up for the study.

Various parameters like age and sex distribution, time interval between consumption of corrosive and presentation to hospital with stricture, location of stricture, need for tracheostomy, and definitive surgical procedures undertaken were analysed.

Using these parameters, a study was done with a specific focus on the different modalities in the management of these strictures.

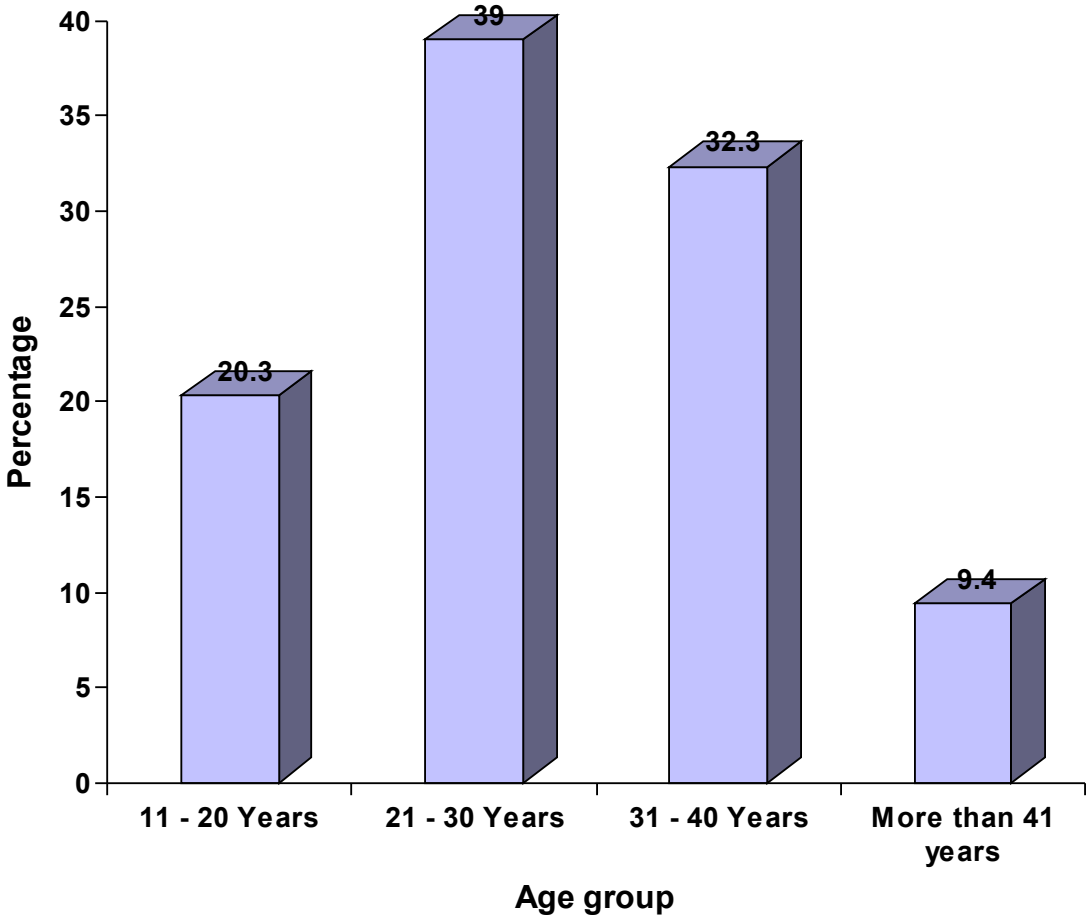
AGE DISTRIBUTION

TABLE – 1

Sl.No	Age group	No. of cases	Percentage
1.	11 – 20 years	10	20.3%
2.	21 – 30 years	19	39%
3.	31 – 40 years	16	32.3%
4.	More than 41 years	4	9.4%
	Total	**49**	**100%**

From the above table one could appreciate 45 of the 49 cases were less than 40 years category. This is the most productive age group. The maximum number of patients were belonging to the 21 – 30 years category.

AGE DISTRIBUTION



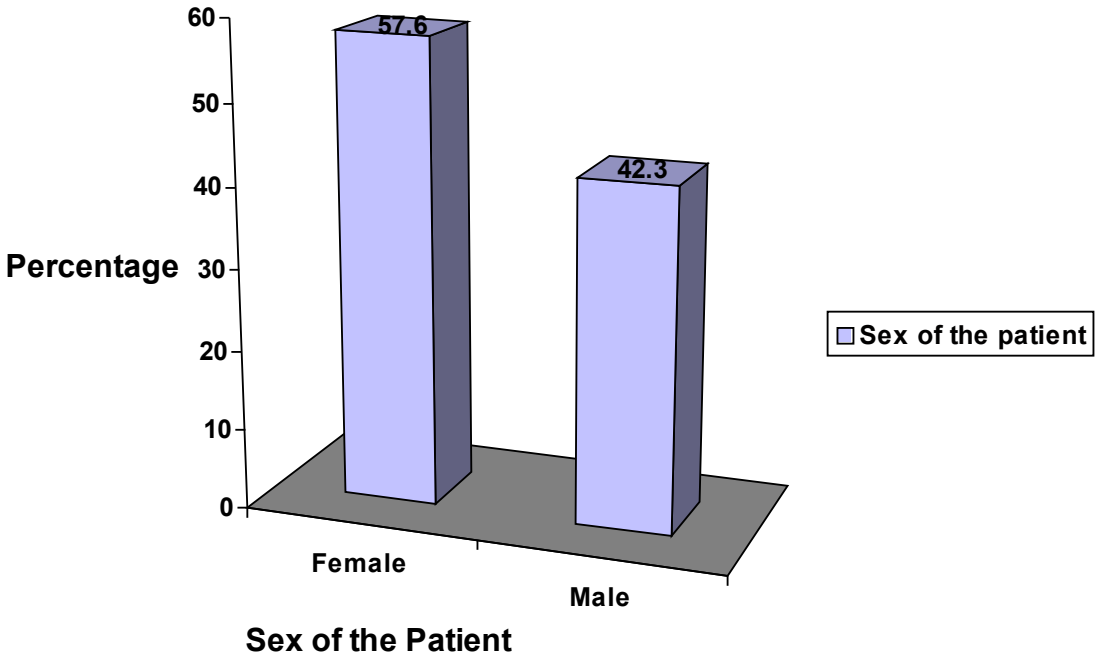
SEX DISTRIBUTION

TABLE – 2

Sl.No	Sex of the patient	No. of cases	Percentage
1.	Female	28	57.6%
2.	Male	21	42.3%
	Total	**49**	**100%**

In this study there were 21 male patients and 28 female patients. Despite the popular notion that women tend to commit more suicide. In India 42.3% of study population were men.

SEX DISTRIBUTION



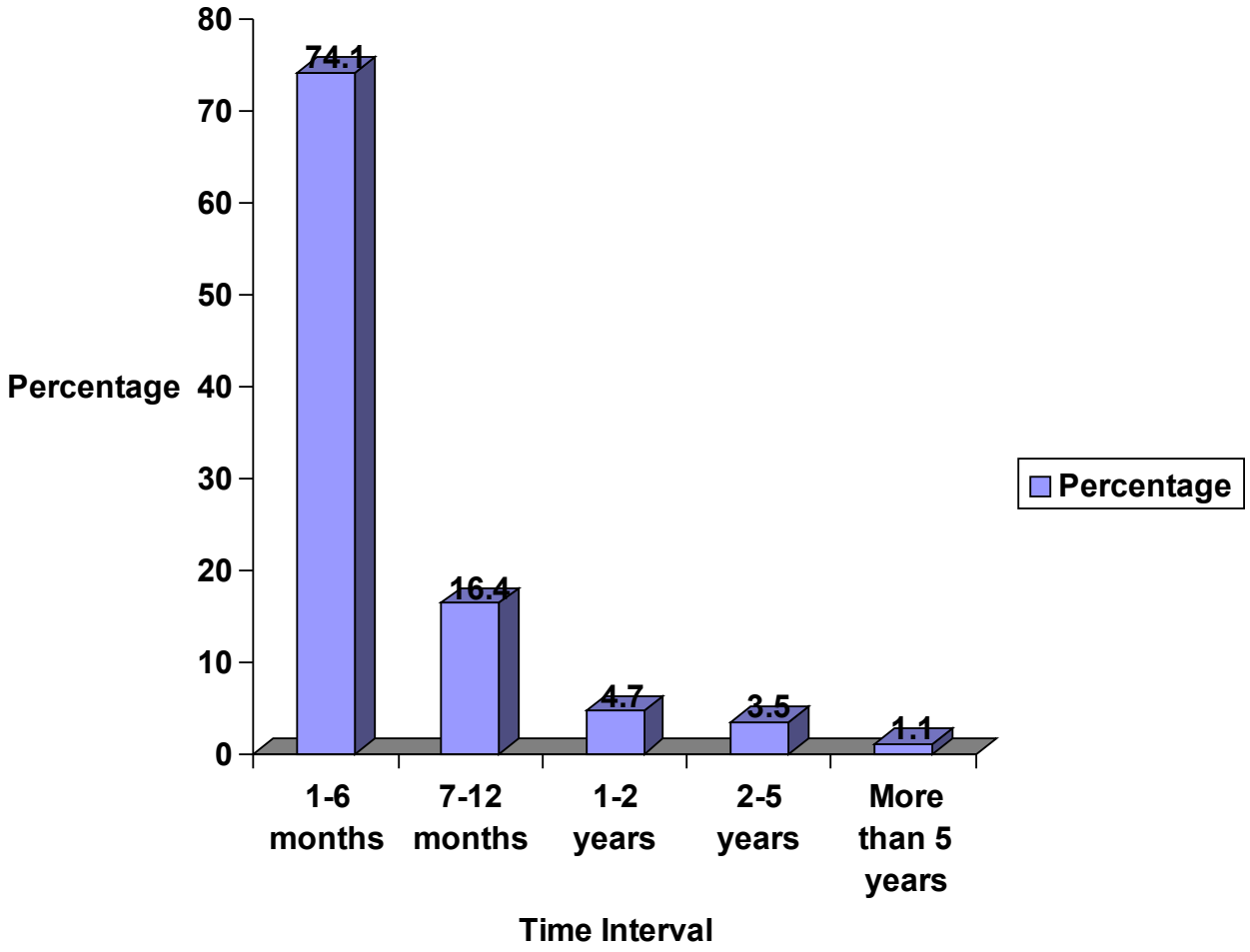
TIME INTERVAL BETWEEN CONSUMPTION OF CORROSIVE TO PRESENTATION WITH STRICTURE

TABLE – 3

Sl.No	Time Interval	No. of cases	Percentage
1.	1 – 6 months	36	74.1%
2.	7 – 12 months	8	16.4%
3.	1 – 2 years	2	4.7%
4.	2 – 5 years	2	3.5%
5.	More than 5 years	1	1.1%
	Total	**49**	**100%**

Except for 5 cases all the cases presented within a year of corrosive ingestion of which 36 (74.1%) presented to the hospital within a period of 6 months time.

TIME INTERVAL BETWEEN CONSUMPTION OF CORROSIVE TO PRESENTATION WITH STRICTURE



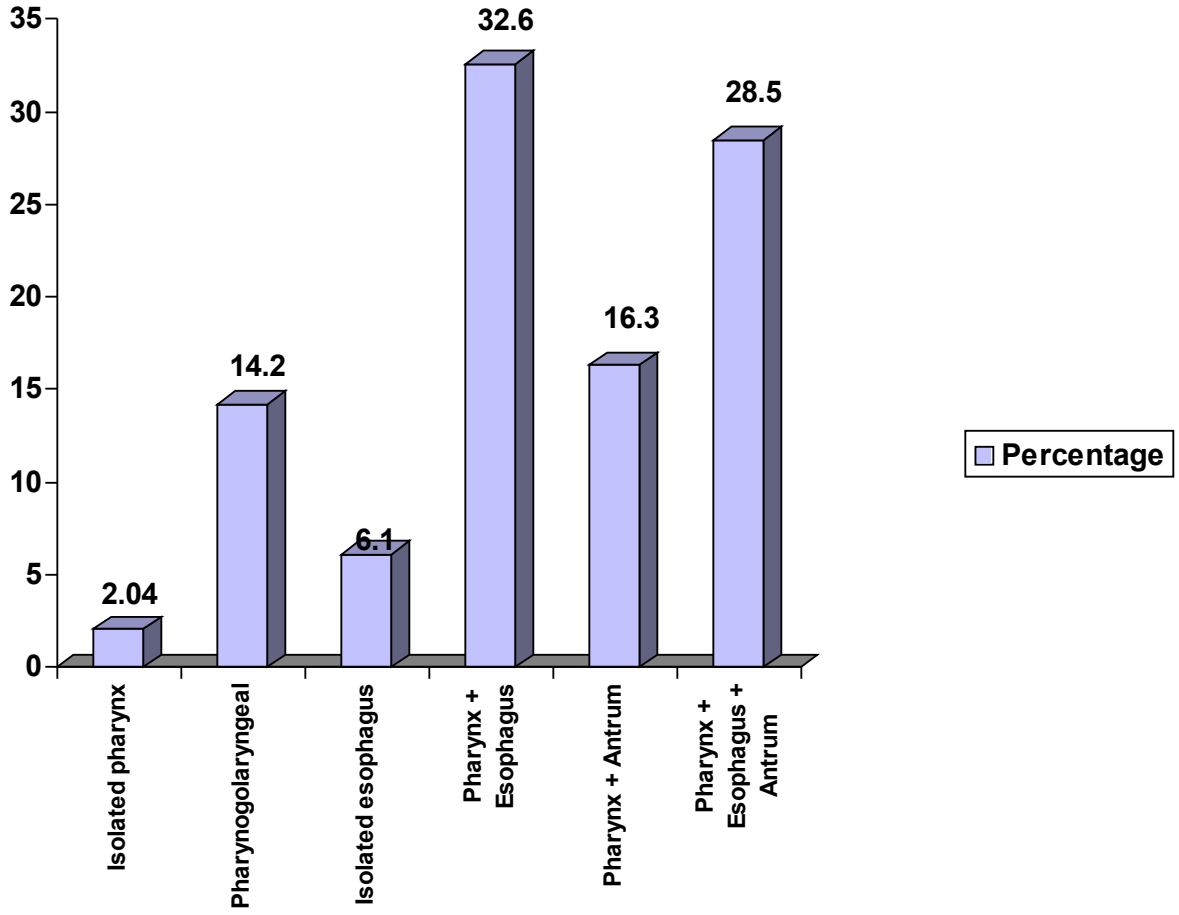
LOCATION OF STRICTURE

TABLE – 4

Sl.No	Location of stricture	No. of cases	Percentage
1.	Isolated pharynx	1	2.04%
2.	Pharyngolaryngeal	7	14.2%
3.	Isolated esophagus	3	6.1%
4.	Pharynx + Esophagus	16	32.6%
5.	Pharynx + Antrum	8	16.3%
6.	Pharynx + Esophagus + Antrum	14	28.5%
	Total	**49**	**100%**

One could appreciate that the pharyngo esophageal stricture (16 cases) and pharyngo esophago gastric strictures (14 cases) form the major chunk of the studied population. This indirectly indicates the volume of the corrosive consumed and the longer extent of injury.

LOCATION OF STRICTURE



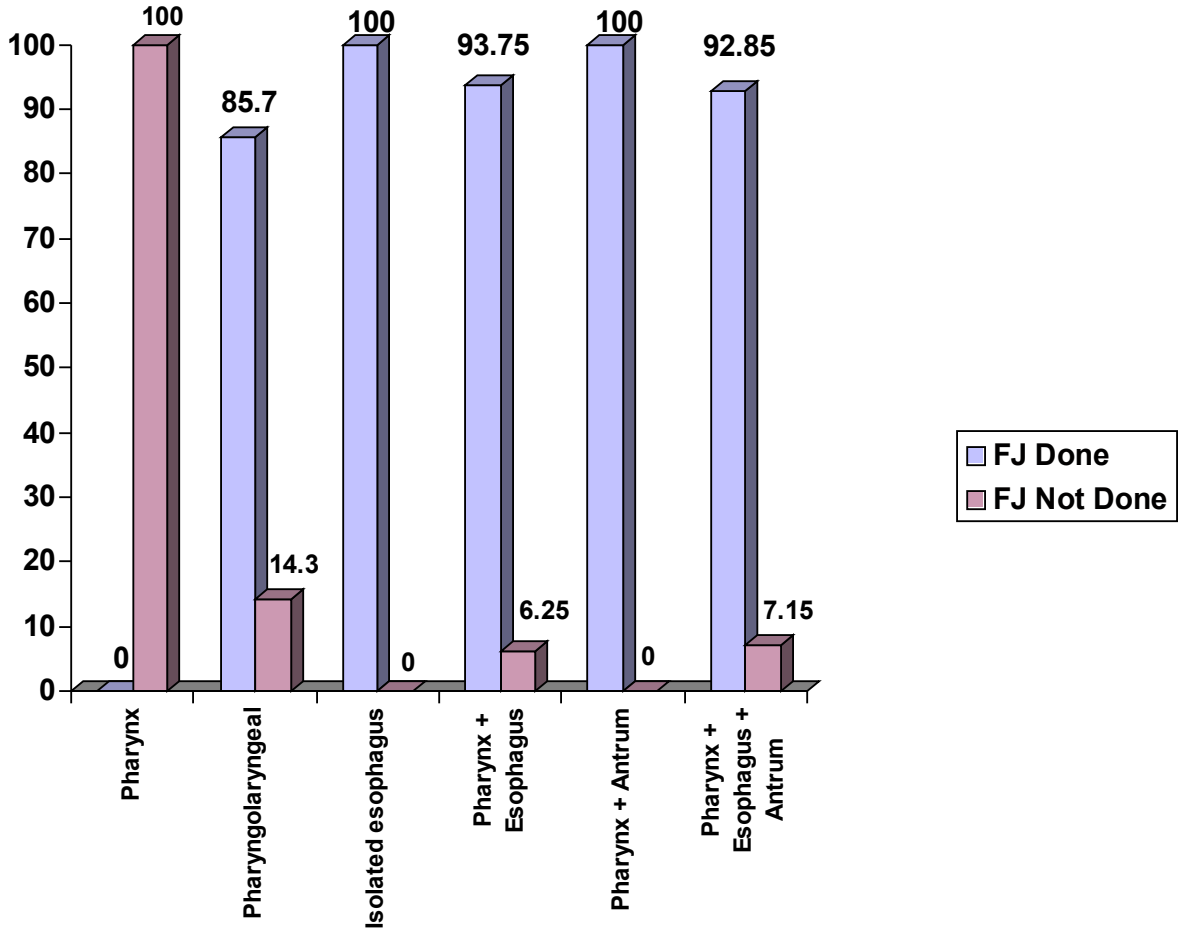
PRE-OPERATIVE FEEDING JEJUNOSTOMY

TABLE – 5

Sl.No	Location of stricture	No. of cases	No. of FJ done	No. of FJ not done
1.	Pharynx	1	Nil	1
2.	Pharyngolaryngeal	7	6	1
3.	Isolated esophagus	3	3	Nil
4.	Pharynx + Esophagus	16	15	1
5.	Pharynx + Antrum	8	8	Nil
6.	Pharynx + Esophagus + Antrum	14	13	1
	Total	**49**	**45**	**4**

Feeding Jejunostomy was done in 45 cases. 1 of the pharyngolaryngeal, 1 of pharynx and esophagus and 1 of pharynx and esophagus and Antrum stricture patients refused to undergo Feeding Jejunostomy citing personal reasons. There were 5 deaths in this series. 2 of these patients who passed away during the delayed post operative period had earlier refused the Feeding Jejunostomy. Patients who developed major leaks were the remaining 2 who refused Feeding Jejunostomy.

PRE-OPERATIVE FEEDING JEJUNOSTOMY



NEED FOR TRACHEOSTOMY

TABLE – 6

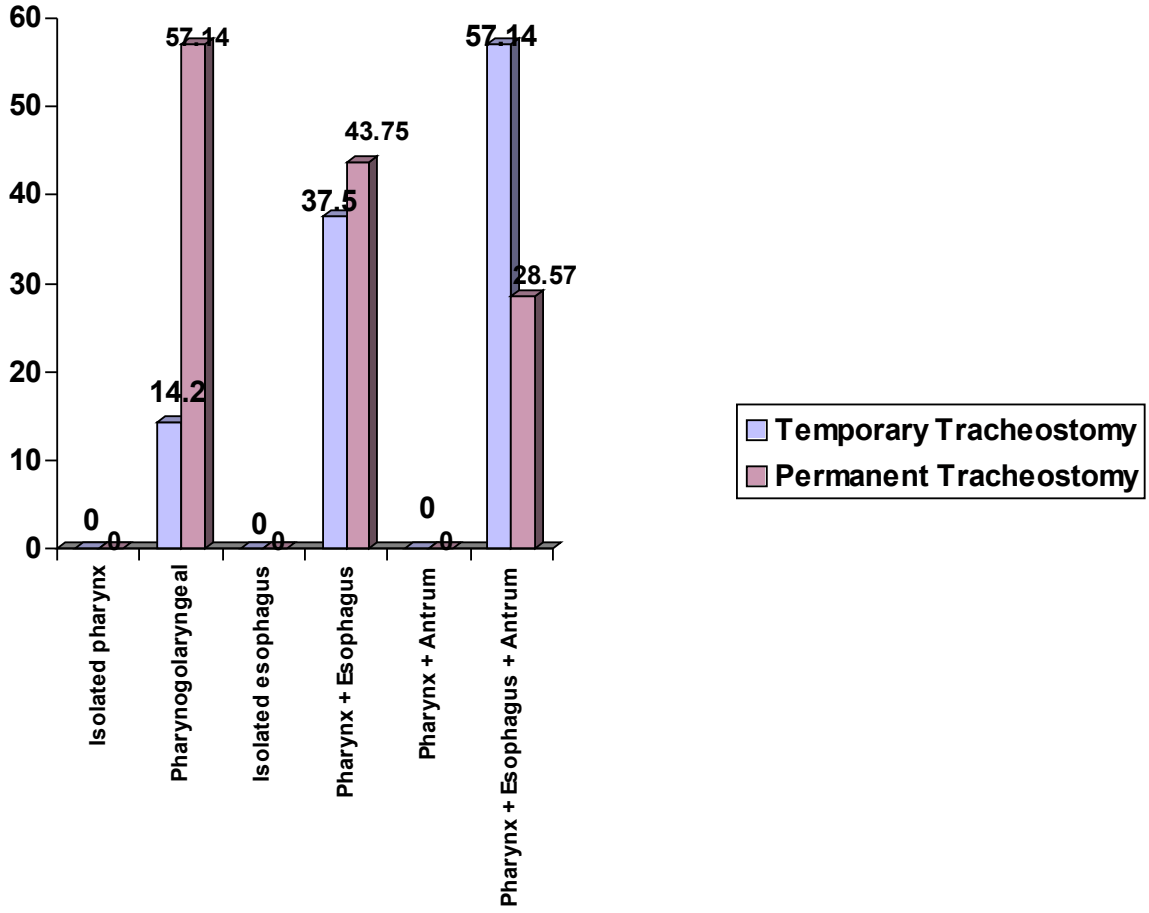
Sl.No	Location of stricture	No. of cases	No. Needing temporary tracheostomy	No. Needing permanent tracheostomy
1.	Pharynx	1	Nil	Nil
2.	Pharyngolaryngeal	7	1	4
3.	Isolated esophagus	3	Nil	Nil
4.	Pharynx + Esophagus	16	6	7
5.	Pharynx + Antrum	8	Nil	Nil
6.	Pharynx + Esophagus + Antrum	14	8	4
	Total	**49**	**15**	**15**

Of the 46 patients who had pharyngeal involvement 15 of them underwent temporary tracheostomy and 15 of them underwent permanent tracheostomy. The indication for temporary tracheostomy were due to repeated aspirations due to severe glottic and pharyngolaryngeal damage. In acute set up temporary tracheostomy helps one to tide over the laryngeal stridor.

The need for permanent tracheostomy in our series were due to the following reasons,

- Severe glottic damage causing absolute glottic stenosis.
- The need for placement of higher anastomosis above the laryngeal inlet.
- After pharyngolaryngectomy.

NEED FOR TRACHEOSTOMY



SURGICAL TECHNIQUES

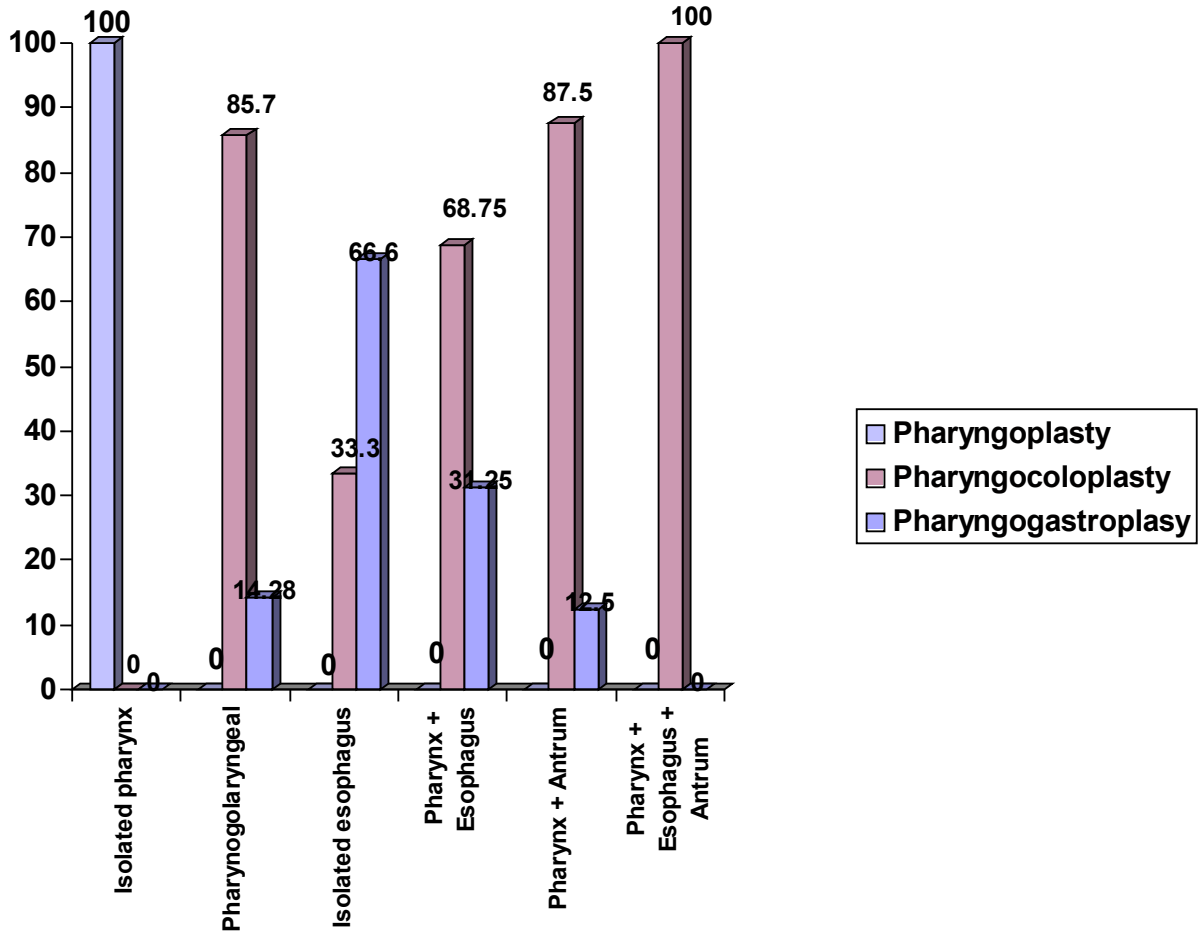
TABLE – 7

Sl.No	Location of stricture	No. of cases	Surgical procedures			
			Pharyngo plasty	Pharyngo colo plasty	Pharyngo gastro plasty	THE
1.	Pharynx	1	1	Nil	Nil	Nil
2.	Pharyngolaryngeal	7	Nil	6	1	Nil
3.	Isolated esophagus	3	Nil	1	2	Nil
4.	Pharynx + Esophagus	16	Nil	11	5	Nil
5.	Pharynx + Antrum	8	Nil	7	1	1*
6.	Pharynx + Esophagus + Antrum	14	Nil	14	Nil	Nil
	Total	**49**	**1**	**39**	**9**	**1**

* Transhiatal Esophagectomy (THE) was undergone in one patient who had pharynx and antrum stricture and pharyngo coloplasty done.

In this study 1 patient underwent pharyngoplasty alone as she had isolated pharyngeal injury. Of the 7 who had pharyngolaryngeal injury, 6 underwent Pharyngocoloplasty and 1 underwent pharyngo gastroplasty. In 3 of the isolated esophageal stricture, 1 underwent pharyngocoloplasty, 2 underwent pharyngogastryplasty. Of the 16 pharyngoesophagus strictures, 11 underwent pharyngocoloplasty and 5 underwent pharyngogastroplasty of the 8 pharyngogastric stricture patients, 7 underwent pharyngocoloplasty and 1 pharyngogastroplasty. In this group 1 patient underwent THE and went on to have pharyngocoloplasty. In the pharyngo esophago gastric stricture group all of them underwent pharyngocoloplasty.

SURGICAL TECHNIQUES



ANASTOMOTIC LEAK

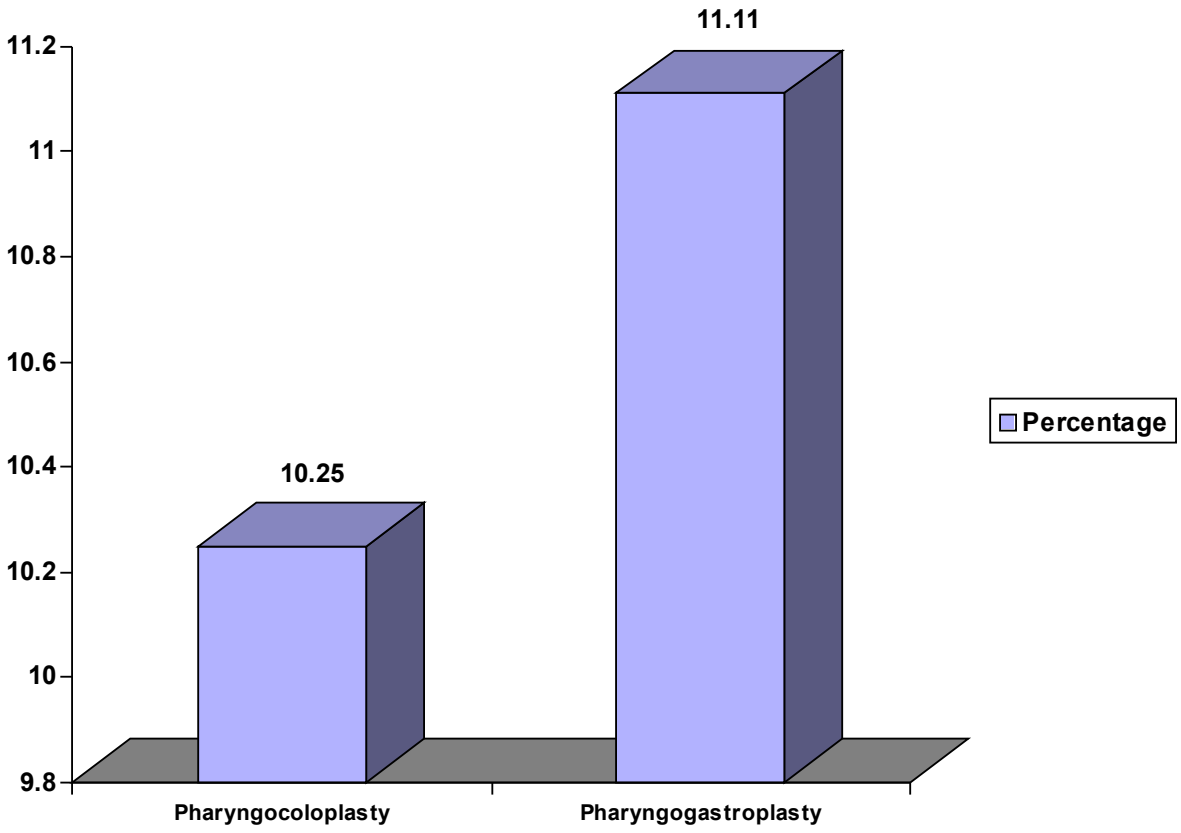
TABLE – 8

Sl.No	Type of Anastomosis	No. of cases	Cervical leak		Abdominal leak	
			No. of cases	Percentage	No. of cases	percentage
1.	Pharyngocolo plasty	39	4	10.25%	1	2.56%
2.	Pharyngogastro plasty	9	1	11.11%	Nil	Nil
	Total	48	5	21.36%	1	2.56%

Among the 39 pharyngocolo plasty patients, 4 (10.25%) of them had neck leak and one had abdominal leak.

Of the 9 pharyngogastro plasty patients, 1 (11.11%) had cervical leak.

ANASTOMOTIC LEAK



ANASTOMOTIC STRICTURE

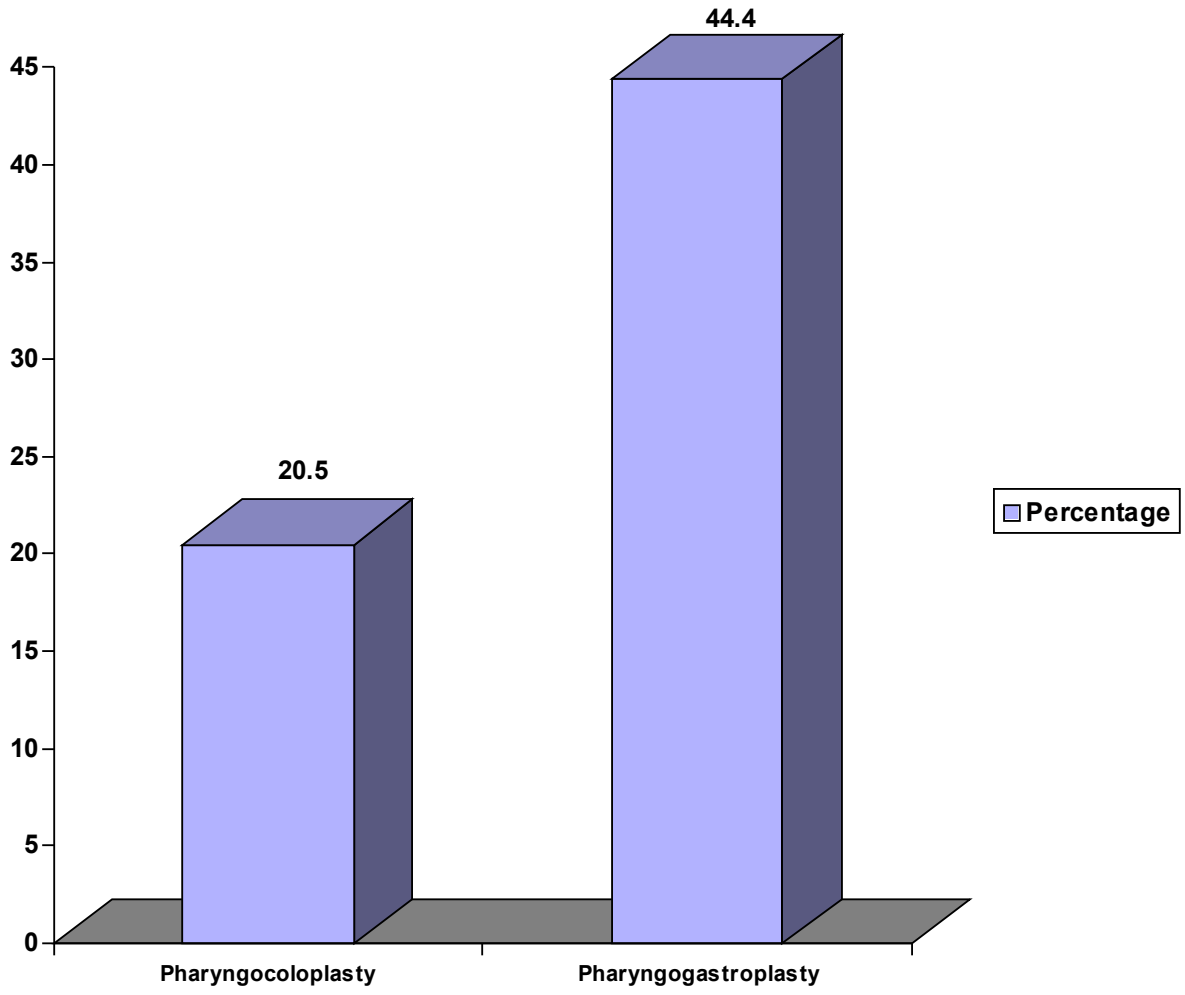
TABLE – 9

Sl.No	Type of Anastomosis	No. of cases	Anastomotic stricture		Treatment given	
			No. of cases	Percentage	Dilatation	Re-exploration
1.	Pharyngocolo plasty	39	8	20.5%	5	3
2.	Pharyngogastro plasty	9	4	44.4%	3	1
	Total	48	12	64.9%	8	4

Of the 39 patients of pharyngocolo plasty, 8 of them developed anastomotic stricture. In these 8 patients, 5 underwent dilatation and 3 underwent re-exploration of the neck anastamotic.

Of the 9 patients who underwent pharyngogastro plasty, 4 had anastomotic stricture, 3 of them underwent dilatation and one underwent re-exploration.

ANASTOMOTIC STRICTURE



MORTALITY

There were totally 5 deaths observed in this study. 2 of them died within one month post-operative period due to post-operative sepsis following anastomotic leak. One case died after 2 ½ years due to unknown sepsis. 2 of them died by committing suicide due to social stress.

Psychiatric counselling was given to all patients to reduce the social stress in their life. Most patients recovered well. Patients were clubbed into self-help groups to help each other and to restore their normalcy in short period of time.

PATIENT CHARACTERISTICS

Total number of corrosive admission:

Total strictures treated n = 49

CHARACTERISTIC	NUMBER OF PATIENTS
AGE BASED	
11 – 20 years	10
21 – 30 years	19
31 – 40 years	16
more than 41 years	4
GENDER BASED	
Female	28
Male	21
INTERVAL BETWEEN CORROSIVE CONSUMPTION AND PRESENTATION WITH STRICTURE	
1 – 6 months	36
7 – 12 months	18
1 – 2 years	2
2 – 5 years	2
More than 5 years	1
LOCATION OF STRICTURE	

Isolated pharynx	1
Pharyngolaryngeal	7
Isolated esophagus	3
Pharynx & esophagus	16
Pharynx & antrum	8
Pharynx & esophagus & antrum	14

PRE OPERATIVE FEEDING JEJUNOSTOMY

Number with FJ	45
Number without FJ	4

NEED FOR TRACHEOSTOMY

No tracheostomy	19
Temporary tracheostomy	15
Permanent tracheostomy	15

SURGICAL RECONSTRUCTION TECHNIQUES

Pharyngoplasty	1
Pharyngocoloplasty	39
Pharyngogastroplasty	9

MORBIDITY

Cervical leak	5

Abdominal leak	1
Delayed stricture	12

MORTALITY

Within six months (POD)	2
6 months – 1 year	1
more than 2 ½ years	2

OBSERVATIONS

Corrosive injury to the upper aerodigestive system and scarring of the pharynx, hypopharynx and esophagus is a challenging problem. A complicated mechanism of swallowing and breathing may occur by the development of a cicatrial process in the pharynx or esophagus.

In this study an analysis has been made on the corrosive injuries with respect to various parameters like age group, gender, severity of stricture, location of stricture and surgical procedures opted.

Majority of patients in the present study are young adults and middle aged persons. Almost all cases had a cause being a suicidal attempt.

Among the 49 cases under study 42.3% were males and 57.6% were females. There was a more female distribution. Beyond 40 years majority were male.

Most of the cases presented to the hospital within six months of corrosive ingestion with complaints of dysphagia. This constituted to about 74.1% of cases.

The percentage distribution of various strictures in the present study almost matches that of standard literature. Pharynx in combination with esophagus or antrum is the commonest site. The esophagus is commonly involved because it is narrowed by aortic arch and left main bronchus.

Most of the cases presented to the hospital within 6 months of corrosive ingestion with complaints of dysphagia. This constituted to about 74.1% of cases.

Laryngeal involvement in the form of epiglottic scarring and glottic stenosis is

found to be common in pharyngeal strictures and these cases needed preoperative tracheostomy for effective tracheobronchial toileting.

It was found that preoperative feeding jejunostomy had significantly improved the nutritional status and thereby the surgical outcome.

In the present study, totally 49 cases were subjected to definitive surgery, of which about 39 pharyngo coloplasties and 9 pharyngo gastro plasty were done. All the coloplasties were left colon based and none was right colon based. All was through retrosternal route. Only one case of pharyngo coloplasty was associated with transhiatal esophagectomy.

There are two schools of thought. Some prefer right colon and the others prefer left colon.

Ronald Belsey et al, of England with extensive experience in late management of corrosive stricture considered iso peristaltic left colon as ideal conduit for esophageal replacement for the following reasons.

i) The regular and compliant blood supply from the left colic artery and well developed marginal arteries providing linear interposition without kinking

ii) Viscus is sufficient to replace the entire esophagus upto pharynx.

iii) Anatomically more compliant for esophageal anastomosis and trained to propel solid bolus.

iv) Progressive improvement in colonic propulsive potential and the eventual development of active peristalsis

Protagonists of right colon as an ideal conduit have the following reasons to say so:

i) Right colon takes the shortest route to cervical portion. So there is no risk of kink.

ii) There is continuity of peristalsis of esophagus.

iii) Intact ileocaecal valve decreases hazard of gastro colic regurgitation.

We have done 9 gastric tube esophagoplasty, all retrosternal. We do gastroplasty only when the stomach is totally free of scarring and there is no perigastric adhesion. Only 1 case of esophagectomy has been done. Though there are numerous studies quoting the advantages and safety of routine esophagectomy, we advocate esophagectomy only for those cases when there is no posterior mediastinal scarring or when a complication such as esophageal perforation has occurred.

Bassiouny et al[3]**,** from Egypt has done a comparative study of retro sternal v/s. posterior mediastinal coloplasty and he concluded that there is no significant difference between the two routes from function point of view. But the operative time required and complication rate were most in posterior mediastinal coloplasty. The reason to remove esophagus are to eliminate risk of malignancy, cyst formation and empyema.

Cervical anastomotic leak rate is least in the present study for both coloplasty and gastroplasty. Anastomotic leak can be minimized by taking adequate care to preserve the vascularity of the conduit, adequate mobilization of conduit to avoid tension in the anastomotic site, selecting an appropriate site free of scarring for anastomosis.

Stricture rate in present series is 20.5% for coloplasty and 44.4% for gastroplasty.

The causes of anastomotic stricture can be any one of the following:

a) Technical error
b) Anastomotic leak
c) Progressive scarring
d) Graft ischaemia

Majority of strictures responded to endoscopic dilation with restoration of normal swallowing. Only 4 patients needed revision of anastomosis with stenting.

Compared to pharyngeal anastomosis, esophageal anastomosis has got lower incidence of leak and stricture rate in our study. This is because of more extensive scarring of the pharynx and very difficult anastomosis to the hypopharynx.

Higher levels of anastomosis increases the incidence of swallowing in co-ordination and aspiration of food.

The mortality rate in our series is 5. Two died of anastomotic leak and two others by suicide.

We have seen only two patients who have come with malignancy in native esophagus. The first patient had gastrojejunostomy for antral stricture and esophageal stricture was managed conservatively. She presented with malignancy 20 years after ingestion. The second patient who underwent subcutaneous colopasty in 1979, has now come with esophageal malignancy.

CONCLUSION

From the present study, I would like to draw the following conclusions,

- Corrosive injury as a form of suicidal attempt is more common in the age group of 20-30 years with a slightly high percentage of female patients.
- Most of the patients present within 6 months for definitive reconstructive surgery.
- Pharyngeal injuries in isolation or in combination with esophagus or stomach is common due to the large volume of corrosive ingested.
- Pharyngeal strictures are associated with high incidence of upper respiratory tract complication in the form of laryngeal stenosis and scarring needing tracheostomy.
- Feeding jejunostomy is found to provide significant good out come and less complications after surgery.
- Surgical reconstruction is a challenging problem because of technical difficulties.
- Colon is the preferred conduit.
- Anastomotic stricture can be managed by endoscopic dilatation and rarely need a reexploration with stricturoplasty and stenting.
- Self dilatation prevent the need for regular endoscopic dilation.
- Our policy is not to do esophagectomy in all patients.

- The quality of life (QOL) is better in patients who do not develop anastomotic narrowing, pharynx is spared and where there is no need for tracheostomy.

- Though there is a theoretical risk of malignancy in retained esophagus, we have seen only two patients with malignancy.

BIBILIOGRAPHY

1. **Anantha Krishnan N; Rao KS. , Rajendran**. Mid colon esophago – coloplasty for corrosive esophageal stricture Aust NZ J Surge 1993 ; 63 ; 389-95.
2. **Anantha Krishnan .N, M. Nachiappan, K.S.V.K. Subba Rao.** Island PMMK flap for pharyngoesophageal stricture prior to esophagocoloplasty. J.R. Coll Surg. Edinb 2001 ; 46 202 –206.
3. **Bassisouny IE, Balnassy AF :** Transhiatal esophagectomy and colonic inter position for caustic esophageal stricture J.Paediatric surgery. 27(8) : 1091-6-1992.
4. **Bockus** – Gastro enterology Vol 2 (4^{th} Edition)
5. **Canty TS SR, Lasarso De.** One Stage Esophagectomy and in situ colonic inter position for esophageal replacement in children J.Paediatric surgery. 1997 ; 32;334-336.
6. **Chandramohan et al,** Corrosive injury to the upper gastrointestinal tract – Strategies for a better outcome – FP 4.6 – Journal of Royal College of Surgeons of Edinburgh and Ireland. The surgeon supplement Jun 2005 Vol 03; No:3 S9.
7. **Chandramohan et al,** Bridging long gap – a new technique of pharyngogastroplasty in corrosive pharyngeal stricture – The Japanese Journal of Thoracic and Cardiovascular Surgery Vol S3 Supplement 2 September 2005 ISE 7 – 2 ; Pg.No.273.
8. **Chandramohan et al,** A new technique of colopasty in the management of complex pharyngo esophago gastric stricture augments blood supply and avoids leak, necrosis and redundant colon – The Japanese Journal of Thoracic and Cardiovascular Surgery Vol S3 Supplement 2 September 2005 ISE 7 – 1 ; Pg.272.
9. **Chandramohan et al,** The management of conduit necrosis in Esophageal Surgery – Abstract No.410, Diseases of the Esophagus, Vol 17 Supplement 1 2004 ; Pg. A66.
10. **Chandramohan et al,** Pharyngo esophago gastric corrosive stricture – Dilemma in management to eat or to speak with experience in 35 patients – Abstract No.409, Diseases of the Esophagus, Vol 17 Supplement 1 2004 ; Pg. A66.
11. **Fujita H, Inoue Y, et al,** Pharyngoesophageal by pass using a free jejunal graft for corrosive stricture – a case report. Jpn J Surg 1991 ; 21(6); 682-684.
12. **Gallardo, et al,** Treatment of esophageal stenosis with Savary – Gilliard Balloon is

children. GEN 1995 Jan-Marc ; 49(1) ; 15-22.

13. **Gormal RL, Khin Maung Gyi, MT, et al.,** Initial Symptoms as Predictor of Esophageal Injury in Alkaline Corrosive Ingestion.Am.J.Emgi. Med.1992, 10 ; 189 – 194.
14. **Gupta DK. Kataria R. Bajpai M.**Gastric Transposition for esophageal replacement in children – an Indian experience. Euro J Paediatric Surgery 1997 ; (Jun) 7 : 143 – 146.
15. **Gupta S, et al,** Surgical management of corrosive strictures following acid burns of upper gastrointestinal tract. Eur J Cardiothoracic Surg 1996 ; 10(11) : 934 – 940.
16. **Holder TM, Ashcraft K. Leape L :** The Treatment of Patient with Esophageal stricture by local steroid injection. J.Paediatric Surgery H:646-653, 1969.
17. **Kirsh M.M., Peterson .A. Brown JW, Orringer MB, Ritter F, Sloan M.** Treatment of Caustic Injuries of the esophagus, a Ten year experience, Ann Surgery 88 :675,1978.
18. **Popovici Z, et al,** Results of the surgical treatment of severe caustic pharyngo esophageal stenosis. The value of complete reconstruction of the pharynx by transposition of the ileum and colon. Chiurgie 1998 ; 123(6).
19. **Rajinder P.Gandhi, Arthur Co-op., et al,** Successful management of esophageal strictures without resection or replacement. J.Paediatric Surgery. 1989 ; 24:745-750.
20. **Sabiston** – Text Book of Surgery (16th Edition) 2001 ; 717-719.
21. **Schakelford's** Text Book on Alimentary tract (5th Edition) Vol 1.
22. **Schwartz** – Principle of surgery (7th Edition) 1999.
23. **Sleisenger and Fordtran** – Gastrointestinal Disease – Vol 1 (6th Edition) 1990 ; 335 – 345.
24. **The Esophagus – Donald.O.Castell, Joel E.Ritcher** (3rd Edition) 1999 ; 557-563.
25. **TiTk, et al,** Esophageal resection with pharyngogastrostomy for corrosive stricture of pharynx and esophagus Br J Surg 1980 ; 67(11); 788-800.
26. **TiTk, et al,** The Surgical treatment of combined pharyngeal and esophageal stricture, Ann Acal Med Singapore 1981 ; 10:151-156.
27. **Wu.Mh.Lai. WW. et al.,** Prevention and management of stricture after hypopharyngocolostomy, esophagocolostomy. Ann. Thoracic Surg 1994 ; 58(1) : 108 –

111.

28. **Yaraba O.Osmanodlu H et al,** Esophago coloplasty in the management of post corrosive stricture of esophagus, Hepatogastroenterology. 1998 ; 45 : 59 : 64.